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Monitoring asthma in childhood: symptoms, exacerbations and quality of life

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ABSTRACT Monitoring asthma in children in clinical practice is primarily performed by reviewing disease activity (daytime and night-time symptoms, use of reliever medication, exacerbations requiring frequent use of reliever medication and urgent visits to the healthcare professional) and the impact of the disease on children's daily activities, including sports and play, in a clinical interview. In such an interview, most task force members also discuss adherence to maintenance therapy and the patients' (and parents') views and beliefs on the goals of treatment and the amount of treatment required to achieve those goals. Composite asthma control and quality of life measures, although potentially useful in research, have limited value in clinical practice because they have a short recall window and do not cover the entire spectrum of asthma control. Telemonitoring of children with asthma cannot replace face-to-face follow-up and monitoring because there is no evidence that it is associated with improved health outcomes.

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To monitor asthma control in children interviewing the child and parents is preferred over composite control scores http://ow.ly/JbqnR

Introduction

The ultimate goal of asthma treatment is to achieve and maintain clinical control and reduce future risks to the patient. To reach this goal in children with asthma, ongoing monitoring is essential. Recently, a European Respiratory Society Task Force on Monitoring Asthma in Childhood was published [1].

Although asthma guidelines place a strong emphasis on monitoring asthma control, there is no gold standard for asthma control. The Global Initiative for Asthma (GINA) proposes to define levels of asthma control based on clinical manifestations, forced expiratory volume in 1 s (FEV_1) and expected future risk, and classifies patients as well-controlled, partly controlled or uncontrolled [2]. Similarly, the British Thoracic Society (BTS) guidelines for asthma control are based on clinical manifestations and FEV_1 [3]. The National Asthma Education and Prevention Programme (NAEPP) defines control as "the degree to which the manifestations of asthma are minimized by therapeutic interventions and the goals of therapy are met" [4].

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The aims of this review are to provide an in-depth discussion of the evidence for the usefulness of different tools available to monitor symptoms, exacerbations of asthma and quality of life (QoL) in children with asthma. In particular, we will discuss monitoring in view of appropriateness in different age groups. In this issue of the *European Respiratory Review*, three other articles will address general considerations on monitoring asthma in children, lung function and inflammatory markers, and management-related issues [5–7].

After establishing the diagnosis and agreeing on a treatment plan, children with asthma need to be followed up regularly to allow adequate provision of self-management education [8]. This usually takes at least two educational and instructional sessions, in which children and parents are encouraged to express concerns, questions and beliefs; in addition, inhalation techniques are taught and checked. Afterwards, most task force members will review the patient at least twice a year to discuss the degree of asthma control achieved and to evaluate whether maintenance treatment should be modified accordingly.

Monitoring symptoms

The key symptom of asthma is wheeze, caused by intrathoracic airway narrowing. This is usually accompanied by shortness of breath, chest tightness and cough (table 1). For patients, the things they hate most about their asthma, apart from having to take medication on a daily basis, are asthma attacks and the limitations asthma imposes on their daily activities including sports and play [9].

Focusing on such patient-centred outcomes during follow-up may be enhanced by starting the consultation by asking "What is useful for you to talk about today?", instead of the usual "How has your asthma been lately?" This can be followed by asking for specific symptoms (table 1). A review of reliever medication use is recommended in asthma guidelines as an expression of asthma control. Most task force members believe that a review of the much more important daily use of controller medication is of value at every follow-up visit [10].

Symptoms (including limitation of activities such as exercise and play) and rescue medication use are distinct domains in the clinical expression of asthma, independent from exacerbations, lung function and inflammation [11]. Children vary considerably in the degree of airway narrowing they perceive as dyspnoea of sufficient severity to prompt the use of reliever therapy [12]. It is likely that psychological factors, including anxiety and depression, are related to the burden imposed on the patient by symptoms of asthma, influencing their expression and perceived severity and impact [13]. Most asthma trials use diaries to monitor symptoms, but the evidence does not support the use of such diaries in clinical practice [14]. In addition, daily diaries in asthma have been shown to be unreliable, at least where peak flow is concerned [15]. In summary, it is current practice to ask questions on symptoms listed in table 1, focusing on patient-centred outcomes and medication use (both daily controller and reliever medication) at all visits.

Composite asthma control scores

Since the concept of asthma control has been introduced as a key feature in asthma guidelines, numerous attempts have been made to capture it in a single numerical value.

TABLE 1 Symptoms and consequences of asthma disease activity

Type of symptoms
Wheeze
Shortness of breath
Chest tightness
Cough
Use of rescue medication
Review use of daily controller medication
Pattern of symptoms
Daytime symptoms
Symptoms related to exercise
Night-time symptoms
Seasonality
Impact of symptoms
Limitation in sports, play and daily activities
School absenteeism
Parental work absenteeism
Impact on sleep

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TABLE 2 Comparison of items in the asthma control test (ACT), childhood ACT and asthma control questionnaire (ACQ)

Item	ACT	Childhood ACT	ACQ
Nocturnal awakening	+	+ (child and parent)	+
Severity of nocturnal symptoms			+
Limitation of daily activities	+	+ (child)	+
Shortness of breath	+		+
Wheeze		+ (parent)	+
Use of rescue medication	+		+
Self-rated asthma control	+	+ (child)	
Cough		+ (child)	
Daytime asthma symptoms		+ (parent)	

+: indicates the item is incorporated into the score.

The full range of available paediatric composite asthma control scores has been reviewed elsewhere [16]. The two instruments with the most extensively reported validation are the (childhood) asthma control test, ACT or C-ACT [17], and the asthma control questionnaire (ACQ) [18]. These are compared in table 2. The ACT contains five items, with a recall window of 4 weeks. There is a separate version for children aged 4–12 years (the C-ACT), which consists of four pictorial items that are scored by the children themselves and three verbal items that are scored by the parents. One should be aware that children tend to report their asthma control to be significantly lower than their parents [19, 20]. The ACQ contains six items with a recall window of 1 week; this is supplemented by measurement of FEV_1 as a percentage of predicted ("the seventh question") [18]. Two novel composite asthma control scores take exacerbations into account: the Test for Respiratory and Asthma Control in Kids (TRACK) and the Composite Asthma Severity Index (CASI) [21, 22]. This is important because most symptoms captured in composite asthma control scores occur only, or most severely, during exacerbations, limiting the ability of asthma control scores to capture variations in control over a brief recall window during which no exacerbations occur.

Poor asthma control, as measured by the ACT, C-ACT or ACQ, is associated with reduced lung function, increased risk of exacerbations and elevated exhaled nitric oxide fraction, and is lower in children not regularly using inhaled corticosteroid maintenance therapy [17, 18, 23–27]. Children with asthma and allergic rhinitis have poorer asthma control and a higher risk of exacerbations than those without allergic rhinitis [28, 29]. Children whose parents are concerned about the usefulness and side-effects of inhaled corticosteroid therapy also have poorer asthma control [30], and this association is caused by poor adherence to inhaled corticosteroids [31]. Follow-up studies have shown that changes in composite measures of asthma control reflect changes in the overall clinical assessment of asthma control by physicians, and the need to step up therapy [32]. No studies have assessed whether repeated structured assessment of asthma control by composite control measures helps to improve asthma control during long-term management and follow-up.

Although the concept of a composite asthma control score, which captures overall asthma control into a single numerical value, is intuitively appealing, it is also a contradiction in terms, because it is universally agreed that asthma control is a multidimensional construct [16]. Specifically, it has been recognised that asthma control should encompass both current impairment and future risk of exacerbations [33, 34]. A recent follow-up study in children showed that the degree of asthma control, as assessed by composite asthma control measures, changes over time and shows variable concordance with the risk of exacerbations [35, 36].

Despite their relatively well-documented validation, the ACT and ACQ share three drawbacks which limit their usefulness in clinical practice (table 3). Although the short recall window facilitates reliable recollection of asthma events that have occurred recently, it fails to represent the variable nature of the

TABLE 3 Limitations of using composite measures of asthma control

Short recall window: 1–4 weeks
Do not take asthma exacerbations into account, except TRACK and CASI
Cover only part of the asthma control spectrum (table 1)

TRACK: Test for Respiratory and Asthma Control in Kids; CASI: Composite Asthma Severity Index.

disease. Children may be excellently controlled during one period (or season), and then have much more problematic asthma during another. In addition, asthma exacerbations occur in children with both good and poor short-term asthma control [37–40]. Exacerbations, an important component of asthma control (table 1), are not covered in the ACT, C-ACT and ACQ. This may explain why the agreement between asthma control as assessed by ACT or ACQ, as compared to an assessment using BTS or GINA guidelines, is poor [19, 41]. Specifically, ACT scores appear to underestimate the level of asthma control, as defined by GINA [41].

All task force members assess asthma control during an interview, which may be supplemented by a composite asthma control score to help practitioners cover the range of symptoms and the impact on QoL.

Future research should focus on the: usefulness of composite asthma control scores in improving asthma control in primary and secondary care; external validation and reproducibility of cut-off points in different populations; and comparison of scores with the patient's perception and doctor's assessment of asthma control, and such studies may include lung function and assessment of airway inflammation.

e-health and telemonitoring

A number of studies have examined the impact of guided self-management by mobile phones or web-based platforms on asthma control. These were summarised in a recent Cochrane meta-analysis of 21 studies in adults and children. In this review, e-health initiatives did not improve patients' QoL or reduce exacerbation and hospitalisation rates in children [42]. At present, e-health initiatives are not routinely used in the clinical care of children with asthma. However, differences in study design, the patients included and the type and frequency of interventions makes comparisons of studies difficult, and future studies might focus on specific patient groups who may indeed benefit from specific e-health initiatives.

Exacerbations

Asthma exacerbations requiring urgent medical care, hospitalisation or the use of an oral corticosteroid course constitute one of the most troublesome aspects of asthma to patients [19], and severe exacerbations can be life threatening.

Most asthma exacerbations in children are triggered by viral upper respiratory tract infections [37], but they also occur after exposure to allergens or irritants [43]. The risk of asthma exacerbations is increased in children with poor adherence to maintenance therapy, poor asthma control and elevated exhaled nitric oxide levels, although none of these factors reliably predicts future exacerbation risk [44–47].

All task force members, as supported by guidelines, actively review exacerbations in addition to asthma control at each consultation in terms of severity, frequency and management [2, 3].

Quality of life

A range of paediatric asthma QoL instruments have been developed, encompassing the impact of asthma on children's or their parents' lives. These have been reviewed in detail elsewhere [48]. The instruments have been validated (internal consistency, reliability and concurrent associations with other disease outcomes), but all suffer from psychometric or generalisability limitations [48]. Although QoL correlates with poor asthma control and reduced lung function [49, 50], children with similar degrees of asthma control or lung function impairment show considerable QoL differences, which is partly explained by psychological problems, anxiety and depression [51, 52]. There is consensus that QoL instruments in childhood asthma provide independent additional information on disease status, complementing symptom scores and lung function, and have been recommended as a potentially useful additional outcome parameter to assess response to longer term treatment trials [3, 53]. No studies have assessed whether asthma management based on routine care plus QoL monitoring is superior to routine asthma management in improving asthma control and reducing exacerbations and limitations in sports and play.

Paediatric asthma QoL questionnaires contain between 15 and 48 items, and take between 8 and 20 min to complete [48]. If such instruments are to be used in clinical practice, they are usually completed before the consultation takes place because they are too time-consuming to be part of the routine 10–15 min follow-up consultation of a child with asthma. Although the instruments are designed to measure the impact of asthma on daily life of children, they are primarily developed and suitable for research purposes. It is unknown how asthmatic children and their parents would feel if they were asked to complete the same QoL questionnaire repeatedly during long-term follow-up. The structured format of QoL questionnaires may reduce the desired tailor-made approach in exploring the impact of the disease on an individual child's life, and should therefore not replace a normal doctor–patient–parent conversation. An additional limitation is the cost involved in using copyrighted paediatric QoL questionnaires.

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TABLE 4 Monitoring tools in research and in clinical practice

	Research tool	Use in clinical practice	Comments
Symptoms/limitation of activities/use of reliever medication	Yes	Yes	Also discuss adherence to maintenance medication; ensure proper inhalation technique
Exacerbations	Yes	Yes	Review exacerbations that have occurred and their potential triggers
Quality of life questionnaires	Yes	No	Discussing impact on daily life is part of normal clinical history
Composite asthma control measures, *e.g.* ACT or ACQ	Yes	No	Short recall window do not take exacerbations and exercise limitations into account

ACT: asthma control test; ACQ: asthma control questionnaire.

To date, routine monitoring of QoL in children with asthma does not take place. Studies assessing the usefulness of longitudinal QoL measures as monitoring tools are needed.

Conclusion

In table 4 the monitoring tools used in the research and clinical practice of symptoms, exacerbations and QoL are summarised. Monitoring asthma in children in clinical practice requires a careful review of the impact of the disease on children's daily activities, including sports and play (table 1). In addition, most task force members review adherence to maintenance therapy and the patients' (and parents') views and beliefs on the goals of treatment and the amount of treatment required to achieve those goals. Composite asthma control and QoL measures, although potentially useful in research, have limited value in clinical practice. At present, telemonitoring of children with asthma does not replace face-to-face follow-up and monitoring.

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